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NEW MEASUREMENTS THAT AID IN THE IDENTIFICATION OF ROTYLENCHULUS PARVUS AND R. RENIFORMIS.

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Ten species of Rotylenchulus are currently recognized and some of these species are pathogenic on important crops in tropical and subtropical regions of the world. Presently, only two species of Rotylenchulus are known to occur in the United States (5). The most common of these two species, R. reniformis, causes economic damage on many crops (2,4) and occurs in Alabama, Arkansas, Florida, Georgia, Hawaii, Louisiana, Mississippi, North Carolina, South Carolina, and Texas (5). In the United States, Rotylenchulus parvus has been reported from Arizona, California, and Florida, and its economic importance is unknown (6).

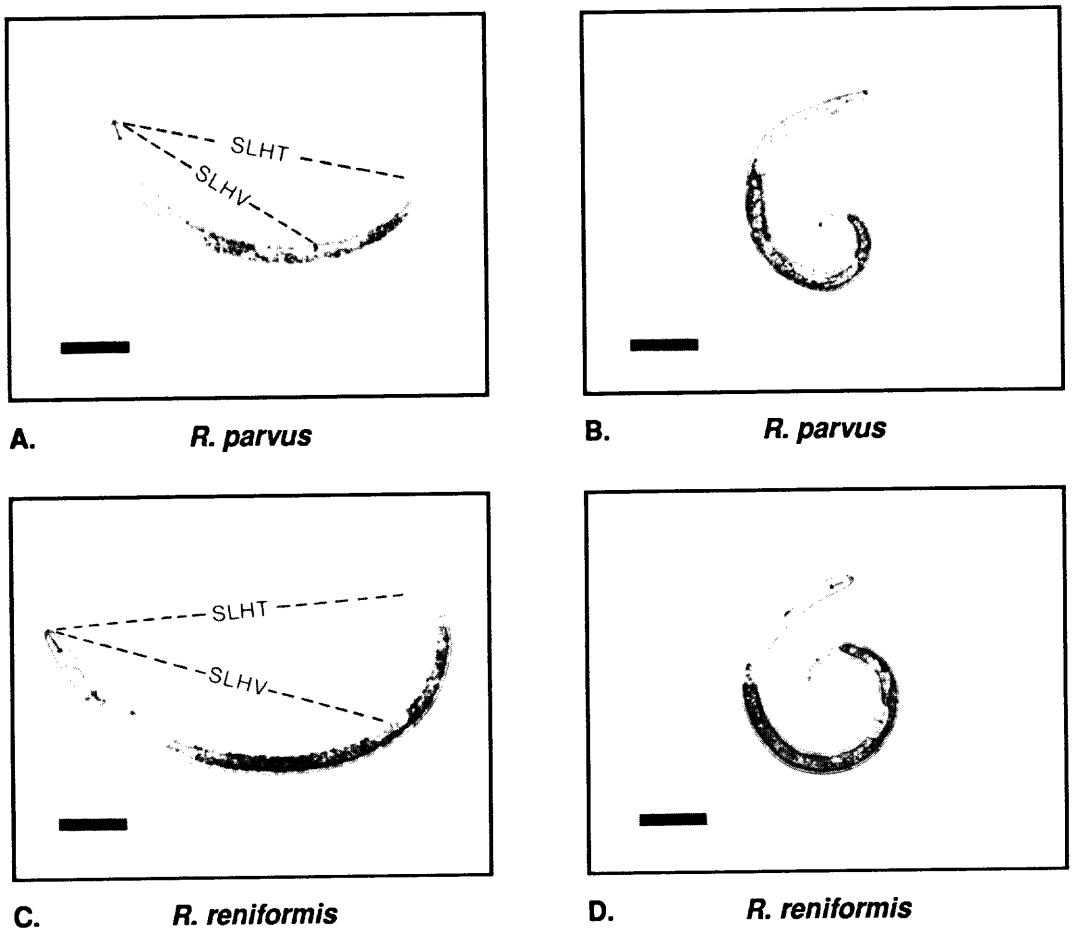

Fig. 1. Similarity in appearance of Rotylenchulus parvus and R. reniformis, and illustration of the straight line head-tail terminus (SLHT) and the straight line head-vulva (SLHV) measurements (A,C) that can be used at low magnifications as a rapid aid to identify these species. The coiled 6-shape in which the nematode body intersects a straight line from head to vulva (B,D) is not considered satisfactory for the SLHT and SLHV straight line measurements. Scale bar = 45 um.

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Currently, plant shipments from Florida to California or Arizona must be certified free of R. reniformis. For routine regulatory purposes it is important to be able to rapidly and efficiently distinguish between Rotylenchulus species.

Table 1. Measurements of immature females of Rotylenchulus parvus and R. reniformis.

Morphological characters[1]	Range		Mean		Standard deviation		Coefficient of var.	
	R. parvus	R. reniformis	parvus	reniformis	parvus	reniformis	parvus	reniformis
Measurements in um								
Body length	245-336	352-426	286	389	17.1	24.9	5.7%	6.4%
Stylet length	13.7-14.7	17.3-18.6	14.2	17.8	0.4	0.5	2.9%	2.8%
Vulva to head distance as % of body length	59.0-68.0	68.2-72.2	64.5	71.6	2.6	2.2	4.0%	2.2%
Vulva to head distance	188-199	253-307	192	278	4.7	17.6	2.5%	6.2%
Straight-line vulva to head distance	125-182	233-296	155	255	22.5	22.2	14.5%	8.7%
Straight-line head to tail terminus dist.	77-216	205-372	134	267	53.5	47.1	39.9%	17.6%

[1]Data are based on measurements of 10 individuals (n=10), except n = 34 for the range and mean body length of R. parvus. R. reniformis was collected in Weslaco, Texas and the R. parvus population originated in Phoenix, Arizona.

Most diagnostic keys for Rotylenchulus species are based on the measurements of immature females, because this life stage is most frequently recovered when soil and root samples are processed by routine methods. The absence or presence of males can also be a useful diagnostic aid. In populations of R. parvus and R. leptus, males occur only rarely, but males frequently occur in populations of R. reniformis and other Rotylenchulus species. As might be expected from the Latin derivation of the word "parvus", which means small, specimens of R. parvus have shorter bodies than R. reniformis. Rotylenchulus parvus immature females also have a shorter stylet, tail, and hyaline portion of tail than those of R. reniformis (Table 1) (1,3). The vulva to head distance, and this distance as percent of body length, is generally greater for R. reniformis than for R. parvus (Table 1) (1,3). Rotylenchulus specimens generally assume a curved or coiled shape and measurements should be made at high magnification. In Florida, R. parvus and R. reniformis may occur singly or in combination. For regulatory purposes, it is important to define these species at low magnification before confirming the identification at high magnification. We have found that two reliable characters can be measured at 10 X or lower magnification and can help in separating the two species. Measurements of the straight-line distance of head to tail terminus and head to vulva can be obtained rapidly for both species after specimens have been heat-killed and observed in water or water agar. The straight-line head to vulva (SLHV) and straight-line head to tail terminus (SLHT) measurements do not follow the contour of the body, but instead span the space created by the concavity of the body curvature (Fig. 1A,C). The body configurations of

Table 2. Average straight-line head to tail terminus (SLHT) and straight-line head to vulva (SLHV) distances for immature females from Rotylenchulus reniformis and R. parvus populations.

Nematode/population origin	Number of observations	Mean (um) SLHT	SLHV
R. reniformis			
Baton Rouge, LA	30	242	243
Homestead, FL	18	262	240
Homestead, FL	15	271	233
Homestead, FL	37	242	244
Homestead, FL	5	257	241
Jay, FL	10	229	245
Miami, FL	12	257	259
Weslaco, TX	10	267	255
R. parvus			
Phoenix, AZ (pop. 1)*	10	134	155
Phoenix, AZ (pop. 2)	12	106	132
Phoenix, AZ (pop. 3)	25	112	144
Phoenix, AZ (pop. 4)	46	115	151
Phoenix, AZ (pop. 5)	23	124	158
Phoenix, AZ (pop. 6)	7	120	124
Phoenix, AZ (pop. 7)	46	99	143
Mauritius**	25	110	134

*Populations were obtained in Florida from shipments of palms, Phoenix canariensis, originating from different locations in Phoenix, AZ.
**Topotypes of R. parvus mounted in glycerin.

specimens within a population vary from a slightly curved C-shape (Fig. 1 A, C) to a coiled 6-shape with heads and tails in close proximity (Fig. 1 B, D). Because of the variability in the body curvature of both species, the coefficient of variability and standard deviation values for these straight-line measurements are higher than the values for body length, stylet length, and V% (Table 1). The occurrence of 6-shape specimens greatly increased the variability of straight line head-tail distance. For this reason, specimens that are excessively curled, i.e., specimens in which the nematode body intersects a straight line drawn from the head to the vulva, should not be used when making the SLHT and SLHV measurements (Fig. 1 B, D). Using these criteria, we have found that mean straight-line head to vulva distances are approximately 100 um shorter for R. parvus immature females than for R. reniformis immature females (Table 2). Based on measurements from 19 populations, we have found that 99% of the R. parvus specimens have SLHV values less than 190 um, whereas 98.4% of the R. reniformis specimens had SLHV values greater than 190. For this reason SLHV means can be obtained by rapidly measuring only a few specimens. The straight-line head to tail terminus distance is more variable, but the mean SLHT distances for R. reniformis immature females or juveniles are significantly greater ($P = 0.01$) than the mean SLHT valves for R. parvus (Table 2,3).

In evaluating the diagnostic value of the SLHT and SLHV characters, a total of over 1000 measurements were made from 19 populations of these two species, and in all cases the average values for populations of R. parvus were consistently

shorter than those for R. reniformis (P = 0.01). In our experience to date, which is based on populations from South Florida, North Florida, Louisiana, Texas, and Mauritius, we have found that the SLHT and SLHV measurements have diagnostic value, and they can be added to other diagnostic characters mentioned above to distinguish R. parvus from R. reniformis.

Table 3. Average straight-line head to tail (SLHT) distance for juveniles of Rotylenchulus reniformis and R. parvus.

Nematode/population origin and host	Numbers of observations	SLHT mean (um)
R. reniformis		
Homestead, FL	28	236
Weslaco, TX	25	228
R. parvus*		
Phoenix, AZ (pop. 1)	12	96
Phoenix, AZ(pop. 4)	8	115

*Populations were obtained in Florida from shipments of palms, Phoenix canariensis, originating from different locations in Phoenix, AZ.

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